

DESCRIPTION OF A NEW SPECIES OF *BONELLIA*  
[ECHIUROIDEA, ANNELIDA] FROM VICTORIA

By BARBARA J. NIELSEN, MSc

Abstract

The male and female of a new species of *Bonellia* (*B. gigas*) are described. The presence of mature breeding animals in southern Victorian waters indicates that the occurrence of the genus in Port Jackson, New South Wales is not necessarily fortuitous, as has been suggested by earlier writers.

Introduction

In 1920 Johnston and Tiegs described a new species of *Bonellia* (*B. haswelli*) from Port Jackson, New South Wales. This description was based on 2 specimens, one obtained by Whitelegge in 1889, the other by Haswell in 1885.

Between 1889 and 1920 there are only 3 records of *Bonellia* occurring in Australian waters, 2 from Western Australia, and one from N. Queensland. Dakin, in his report of the expedition of 1913 to the Houtman Abrolhos Islands, mentions that 2 specimens of *Bonellia* were found. In an earlier paper on the marine biology of Western Australia, he records further specimens obtained by dredging in Freshwater Bay (Swan R. Estuary) and off Garden Island. Hedley (1906) mentions a large specimen from Masthead Island, Queensland.

There are no published records of *Bonellia* from Victorian waters although Dr F. H. Drummond (pers. com.) has seen animals living at Point Lonsdale on 4 occasions, in 1930, 1954, January 1955 and January 1956.

In 1953 the writer saw several animals living on a low reef at Flinders, Western Port and, on a subsequent visit, collected 3 specimens. Two years later in 1955, another visit to the same reef yielded 7 specimens, 3 of which were retained for examination.

Type Locality and Habitat

At the time of writing, this species of *Bonellia* had been observed only at 2 localities in Victoria; Flinders on the W. side of Western Port, and Point Lonsdale on the W. side of the entrance to Port Phillip. It is proposed to designate Flinders as the type locality for this species.

At Flinders the reef on which the animals are found stretches across the bay between the jetty (to the N.) and West Head, a prominent basalt point to the S. protecting the reef from the rough seas of Bass Strait. This reef is accessible only during the very low spring tides (from 0.0 ft to 0.2 ft) although the crest may be uncovered at other times (e.g. on 0.3 ft or 0.4 ft tides). The accessibility of the reef is dependent also on the wind direction, an onshore wind preventing exposure of the reef even if the tides are favourable. Thus the reef remains wholly or partially submerged for the greater part of the year.

It is separated from the shore by a deep channel (2 metres) and is composed of decomposed basalt covered in many places by a sandy mud over which numerous loose rocks are strewn. In general, the *Bonellia* are restricted to the shore side and

the middle of the reef. They live under the loose rocks, usually resting on the surface of the sand, which is always water-logged, as the crest of the reef rises only about 15 cm above very low water mark.

At Point Lonsdale the reef, which partially bars the entrance to Port Phillip, is composed of dune limestone. There is a long wave-platform, broken by deep rock pools, the bottoms of which are strewn with flat pebbles and boulders. The *Bonellia* are found in these pools under the loose rocks.

#### Description of the Female

The female is typical of the genus *Bonellia*. The body is sac-like with a long proboscis, bifurcated at the end, which can be extended to 2 or 3 times the length of the body (Pl. XIV).

The specimens varied in size. In the largest the body was 11 cm long and 4 cm wide; the proboscis was 35 cm long. Most specimens were smaller, the body being about 8 cm long, 4 cm wide and the proboscis 30 cm long. These measurements were made on animals preserved in formalin, after narcotizing with a mixture of ether and sea-water. It is virtually impossible to make accurate measurements of the living animal as it is in an almost constant state of motion, waves of contraction passing down the body-wall so that its shape is always changing.



Fig. 1—Chetae of female (x 100).

The epidermis of the body is of the usual deep green, that of proboscis a paler green, the bifurcation of the latter being edged in pale yellow. The epidermis is covered with transverse rows of flattened papillae which are more prominent towards the posterior end of the animal.

The ciliated groove runs along the length of the proboscis leading to the mouth at its base. The anus is surrounded by broad flat papillae.

On the ventral side of the animal 2 chetae project. These chetae are about 1.12 mm long and have a maximum width of 0.08 mm. About 0.16 mm of each cheta projects through the skin, the remaining portion, imbedded in muscle, being flat and blade-like. The protruding portion is crossed by microscopic alternating bands of dark and light brown. In some animals one or two immature chetae can

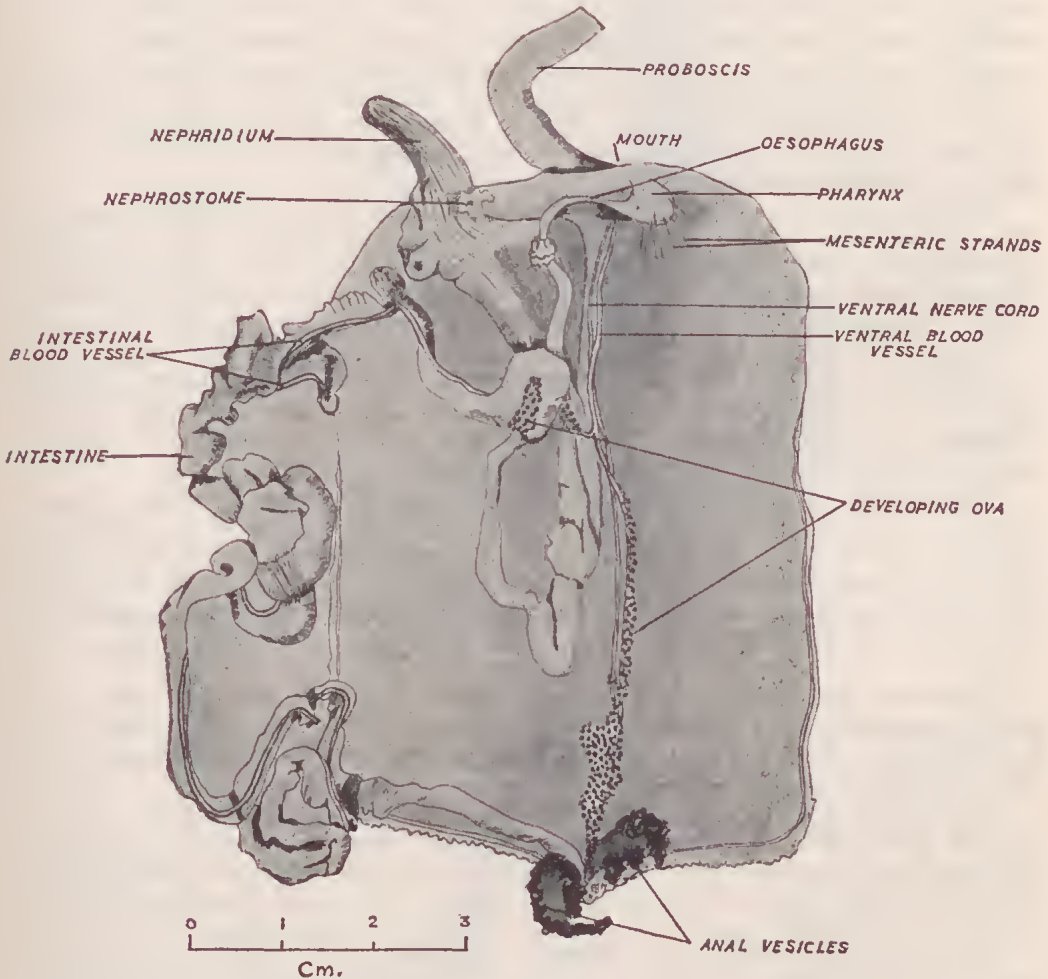


Fig. 2—Female dissected from dorsal side.



be seen imbedded in the skin near the mature chetae. Unlike the chetae of *B. haswelli*, which are curved at their tip, the chetae of this species are straight (Fig. 1).

The external opening of the nephridium lies immediately posterior to the chetae, slightly to the left of the mid-ventral line. During fixation of the animals collected in 1955, portion of the nephridium was extruded through the external opening. The extruded portion was a muscular tube about 8 mm long, its orifice surrounded by short blunt broad papillae. The epidermis of the tube is continuous with that of the body, there being no indication of rupture. The 3 specimens with protruded nephridia were all mature as the internal portions of their nephridia contained fully developed eggs and males. This tube evidently serves to expel the eggs into the surrounding water.

The general anatomy of the female differs very little from that of the European species *Bonellia viridis* (Fig. 2). The mouth opens into a wide pharynx about 1.5 cm long, which leads into a narrow thin-coiled oesophagus. The oesophagus is about 2 cm long and coiled. It opens into a wide thin-walled intestine which is strongly coiled, extending the length of the body and narrowing slightly at the posterior end. The alimentary canal is held in place by numerous mesenteric strands which pass from the body wall to the intestinal wall. There is no equivalent of the siphon described by Johnston and Tiegs in *Bonellia haswelli* and also in *Pseudo-bonellia biuterina*. The pharynx is pale yellow, the intestine bright yellow up to the last loop, which is pale yellow.

The pair of anal vesicles, arising from the hind gut close to the anus, resemble those of the other species. Each consists of a wide thin-walled vesicle into which open about 13 tubes. The latter branch distally 3 or 4 times into smaller tubes, each of which branch into many ciliated funnels which connect the vesicle with the body cavity. The vesicle is pale yellow, the clusters of tubules orange brown. The actual arrangement of the tubes on the vesicle differs markedly from that shown for *B. haswelli*. In this species the tubes are widely separated and are sparsely covered with ciliated funnels, while in the present species the tubes are close together, dividing into many ciliated funnels. These vesicles are held to the body wall by mesenteric strands, many of which join on to the branching tubes.

The vascular system and nervous system are similar to those of other species. The vascular system consists of a ventral vessel which bifurcates at the pharynx to give two vessels which run up either side of the proboscis. Another large vessel, which runs about three-quarters of the length of the intestine from near the level of the external opening of the uterus, enters the ventral blood vessel in this region. The nervous system, macroscopically, consists of a pharyngeal ring and a ventral nerve cord.

The ovary, as usual, is spread along the main ventral blood vessel with a small portion extending as a clump a short distance along the intestinal vessel. It is generally yellow and beset with bright orange spots representing developing ova. The body fluid contained numerous ova which were almost colourless.

The segmental organ or nephridium is on the left side and opens to the exterior just left of the mid-ventral line, as described above. The nephridium is an exceptionally large pale green sac about 5 cm in length in large specimens and extending back at least half-way along the body cavity. The anterior half is thin-walled but the wall becomes progressively thicker posteriorly owing to the development of a strong muscle sheet. The nephrostome is situated one-third of the way from the posterior end, it is bright yellow and strongly crenated. The nephrostome contains many eggs. In one specimen there were 6 males, in another 2, others again were devoid of males.



Fig. 3—Male of *Bonellia gigas*.

### Description of the Male

Of the species of the genus in which the male is known, that of the Japanese species *B. miyajimai* Ikeda (1907) resembles most closely the male of the present species. The male of *B. miyajimai* is 2 cm long while the male of the present species is 1.9 cm long. The male of the European species *B. viridis* is only 0.1 mm long.

The males are worm-like creatures about 1 mm wide at the anterior end tapering to 0.5 mm at the posterior. They are deep green in colour and, as mentioned above, are found in the nephridium of the female. Chetae are not present but there appears to be a sucker or clasper at the posterior end (Fig. 3).

The description of the male is based on a whole specimen stained with Delafield's Haematoxylin and cleared in clove oil, and also longitudinal sections, cut at 10  $\mu$  and stained with Heidenhain's Haematoxylin.

The whole mount revealed the greater part of the anatomy as the body wall is very thin, only one cell thick and there is very little muscle underlying the epidermis, except towards the anterior end.

The epidermis is composed of ciliated columnar cells with darkly staining nuclei, resting on a very thin basement membrane. Beneath these cells there are sparsely scattered strands of longitudinal muscle. At the anterior end there is a thick layer of connective tissue cells. From the wall of the coelom, strands of connective tissue project into the coelom at regular intervals along the wall giving the appearance of segmentation.

The only evidence of an alimentary canal is a long narrow mass of large vacuolated cells with nuclei having much chromatin and a prominent nucleolus, the cytoplasm being clear. This organ extends from the anterior end nearly to the posterior end. There is no mouth, no anus and no evidence of a lumen in the alimentary canal.

The only other organ present is the segmental organ or nephridium which is at the anterior end opening just behind the tip of the animal. It is a long thin tube, about 3 mm long opening to the coelom by a small nephrostome. The lumen is packed with mature sperm.

Floating in the coelom are numerous morulae of sperm, consisting of a large central mass of cells on which are small round balls of developing sperm. The position of the testis is uncertain but sections indicate it may be towards the posterior end of the animal.

It is proposed to call this species *Bonellia gigas*. The type is kept in the Museum of the Zoology Department, University of Melbourne.

The presence of this species as far S. as Western Port, Victoria, indicates that the theory of Hedley (1915) and Johnston and Tiegs (1920) is untenable. These writers suggest that the Sydney *B. haswelli* travelled S. from tropical waters as trochophores and did not breed in the colder waters. It would seem that *B. gigas* is well established both at Flinders and Point Lonsdale. Possibly it is a remnant of the warm water fauna present in this region during Tertiary times. There is strong evidence from fossil marine molluscan fauna that during these periods the seas in southern Australia were much warmer.

### Acknowledgements

The writer wishes to acknowledge the help and encouragement received from the late Professor O. W. Tiegs in investigating this species, and also help from Dr F. H. Drummond in collecting specimens at Point Lonsdale and from Miss E.

Mollison with the relevant literature. The work formed part of a thesis submitted for a degree of Master of Science at the University of Melbourne.

### References

- BALTZER, F., 1928-1934. Echiuroidea (Kükenthal, Handbuch de Zoologie, 2: 62-168, Berlin and Leipzig).
- BLEDOWSKI, R., 1910. Beiträge zur Kenntniss der *Bonellia viridis* (Rol.) und der Phylogenie einiger Coelhelminthen. *Wloclawck, Polen, Druk Brica Piotrowskich*.
- DAKIN, W. J., 1914. Marine biology in Western Australia. *Proc. Roy. Soc. Wcst Aust.* 1: 11-27.
- FISCHER, W., 1922-23. Westindische Gephyreen. *Zool. Anz.* 55, 56: 10.
- HASWELL, W. A., 1885. Jottings from the biological laboratory of Sydney University. *Proc. Linn. Soc. N.S.W.* 10: 331-2.
- HEDLEY, C., 1906. The mollusca of Mast Head Reef, Capricorn Group, Queensland. Part I. *Proc. Linn. Soc. N.S.W.* 31: 453-479.
- , 1915. An ecological sketch of Sydney beaches. *Proc. Roy. Soc. N.S.W.* 49: 15-77.
- IKEDA, I., 1904. The Gephyrea of Japan. *Journ. Coll. Sci. Imp. Univ. Tokyo, Japan* 20: art. 4.
- , 1907. On three new and remarkable species of Echiuroids (*Bonellia miyajimai*, *Thalissema taenioides* and *T. elegans*). *Journ. Coll. Sci. Imp. Univ. Tokyo, Japan* 21: art. 8.
- , 1908. Note on a new deep-sea Echiuroid, *Protobonellia mitsukurii*. *Annot. Zool. Jap.* 6: 258.
- JOHNSTON, T. H., and TIEGS, O. W., 1919. *Pseudobonellia*, a new echiuroid genus from the Great Barrier Reef. *Proc. Linn. Soc. N.S.W.* 44: 213-230.
- , ———, 1920. A new species of *Bonellia* from Port Jackson. *Rec. Aust. Mus.* 13: 73-76.
- MONRO, C. C. A., 1927. On the families and genera of the class *Echiuroidea*. *Ann & Mag. Nat. Hist.* 20, ser. 9: 615.
- SELENKA, E., 1878. The male of *Bonellia*. *Zoo. Anz.* p. 120-121.
- SPENGLER, J. W., 1879. Beiträge zur Kenntniss der Gephyreen. I. Die Eibildung, die Entwicklung und das Männchen der *Bonellia*. *Mitt. Zool. Stat. Neapel* 1 (3): 394.
- WHITELEGGE, T., 1889. List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. *Proc. Roy. Soc. N.S.W.* 23: 163-323.

### Explanation of Plate

#### PLATE XIV

Female of *Bonellia gigas* (Type specimen).